We claim:

1. In an optical scanning device for reading one or more one- or two-dimensional symbologies contained within a symbology image field having a first width, wherein said optical scanning device includes at least one printed circuit board having a front edge with a second width, an illumination light source mounted on said at least one printed circuit board for projecting an incident beam of light onto said symbology image field, said incident beam of light having substantially said second width at said front edge of said at least one printed circuit board and a first height and a third width at said symbology image field, said third width being greater than said second width and at least as large as said first width, and said optical scanning device further including an optical assembly comprising a plurality of lenses disposed along an optical path for focusing reflected light at a focal plane, [said optical assembly including moving means for moving at least one of said plurality of lenses with respect to other lenses of said plurality of lenses to provide a variable field of view,] and said optical scanning device further including a detector disposed on said at least one printed circuit board within said optical path substantially at said focal plane of said optical assembly, [said variable field of view having said first height and said third width,] said detector including a plurality of pixel elements for sensing illumination levels of said focused light, and said optical scanning device further including a processor in communication with circuitry on said at least one printed circuit board for processing said sensed symbology to obtain an electrical signal proportional to said illumination levels and an output means for converting said electrical signal into output data, said output data describing [a gray] an illumination level for each pixel element that is directly relatable to discrete points within said symbology image field, and said processor having a communication path for communicating with a host computer, a combination comprising:

memory means in communication with the processor;

optical framing locator means including a light source for directing light for framing said symbology image within a [selected] field of view [of the variable field of view]; and

machine-executed means coupled with the memory and the processor for controlling said optical scanning device and processing one or more symbologies, the machine-executed means including:

monitor means for monitoring and controlling power consumption of said electronic circuitry, and said illumination and laser light sources; and

image processing means for analyzing and decoding one or more symbologies contained within said framed symbology image field including means for correcting for skewed orientation of said one or more symbologies within a symbology image field.

2. The combination of claim 1, wherein at least portions of said image processing means are selectably downloadable from said host computer.

3. The combination of claim 2, wherein said decoded one or more symbologies is selectably uploadable to said host computer.

4. The combination of claim 1, wherein said light source is a laser diode.

5. The combination of claim 1, wherein said optical framing locator means includes at least one diffractive optical element for transforming the light beam from said light source into a plurality of diverging beamlets having a beamlet spacing at said symbology image field at least as large as said first width.

6. The combination of claim 5, and further comprising at least one refractive optical element for selectively refracting each of said plurality of diverging beamlets at a pre-determined angle.

7. The combination of claim 6, wherein said at least one refractive optical element comprises at least one wedge-shaped prism.

8. The combination of claim 7, wherein said at least one wedge-shaped prism includes a horizontal refracting means and a vertical refracting means.

9. The combination of claim [6] <u>38</u>, wherein a plurality of refractive optical elements are disposed on a rotatable ring

and further comprising a linkage for rotating said rotatable ring in response to movement of said at least one of said plurality of lenses to form said framing light beams to indicate said variable field of view.

10. The combination of claim 9, wherein said linkage comprises camming means.

11. The combination of claim 1, wherein said image processing means processes said one or more symbologies within said symbology image field by:

(i) parsing said output data describing said [gray] illumination level of said image symbology field into a double taper data structure including a first data field, and a second data field, wherein a first set of information related to each said symbology is placed in the first data field and a second set of information related to said symbology image field is placed in the second data field, wherein said first and second sets of information contain at least a pixel bit map describing the [gray] illumination level of each pixel in each said symbology and said symbology image field;

(ii) segmenting said image symbology field to determine a location and type of each symbology within said symbology image field;

(iii) extracting said first set of symbology information for each symbology from said first data field and determining the [gray] level of illumination of each pixel within each symbology;

(iv) removing information describing noise from said first and second sets of information in said first and second data fields, respectively;

(v) electronically scanning symbology information describing location and type of each symbology within each said symbology image field into the second data field, wherein said information describing location and type of each symbology segmented in step (ii) is determined in accordance with the [gray] level determined in step (iii) after noise is removed in step (iv);

(vi) decoding the symbology information scanned in the second data field in step (v); and

(vii) outputting said symbology information for each said symbology.

12. The combination of claim 1, wherein the machine-executed means further includes fuzzy set membership means for decoding said one or more symbologies by determining membership of one or more lines contained in said one or more symbologies by comparing characteristics of said one or more lines to predefined characteristics contained in a look-up table.

13. The combination of claim 1, wherein the machine-executed means further includes means for executing a simulated floating point threshold binary processing process to determine type and location of one or more symbologies within said symbology image field by sampling pixels within predefined areas within said symbology image field to determine [a gray] an illumination level curve for each predefined area to determine a binary threshold within each predefined area and summing each said binary threshold within said predefined area to determine a symbology type and location of each symbology within said symbology image field.

14. The combination of claim 1, wherein the machine-executed means for correcting for skewed orientation of said one or more symbologies within said framed symbology image field executes an average perspective translation process by using the crossing point of two middle lines defined by pixels within an area representing a symbology within a symbology image field to define a center point of said symbology portion of said symbology image field.

15. The combination of claim 1, wherein the machine-executed means for correcting for skewed orientation of said one or more symbologies within said framed symbology image field executes an approximate approach process by using the crossing point of two diagonal lines defined by pixels within an area representing a symbology within a symbology image field to define a center point of said symbology portion of said symbology image field.

16. In an optical scanning device for reading a one- or two-dimensional symbology having a first width, and including at least one printed circuit board having a front edge with a second width, and also including an illumination light source mounted on said at least one printed circuit board, said illumination light source for projecting an incident

beam of light onto said symbology and having a first spectral bandwidth, said incident beam of light having substantially said second width at said front edge of said at least one printed circuit board and a first height and a third width at said symbology, said third width being greater than said second width and at least as large as said first width, and also including a processor for processing sensed symbology to obtain an electrical signal and output means for converting said electrical signal into output data, a combination comprising:

an optical assembly comprising a plurality of lenses disposed on said at least one printed circuit board along an optical path for receiving and focusing light reflected from a symbology to obtain a focused light at a focal plane, [said optical assembly having moving means for moving at least one of said plurality of lenses with respect to other lenses of said plurality to provide a variable field of view];

optical framing locator means disposed on said at least one printed circuit board for framing said symbology to identify an area to be scanned by said scanner, wherein said at least one framing means comprises at least one laser diode for emitting a laser beam and at least one diffractive optic for transforming said laser beam into a plurality of diverging beamlets;

one or more [movable] refractive optical elements for selectively focusing said plurality of diverging beamlets [in response to movement of said at least one of said pluralilty of lenses] for [selectively] forming said laser beamlets within a [selected] field of view [of the variable fields of view]; and

a detector disposed on said at least one printed circuit board within said optical path substantially at said focal plane of said optical assembly for detecting at least a portion of said focused light within said [variable] field of view of said detector, [said variable field of view having said first height and said third width,] said detector for sensing said focused light to obtain a sensed symbology.

17. The combination of claim [16] 41, wherein said movable refractive optical elements include a plurality of prisms spaced apart on a rotatable ring at a predetermined distance.

18. The combination of claim 17, wherein said one or more rotatable ring is rotated by camming means in response to movement of said at least one of said plurality of lenses to build said framing light beams.

19. The combination of claim 16, further comprising:

memory means in communication with the processor;

machine-executed means coupled with the memory and the processor for controlling said optical scanning device and processing one or more symbologies, the machine-executed means including:

monitor means for monitoring and controlling power consumption of said electronic circuitry, and said illumination and laser light sources; and

image processing means for analyzing and decoding one or more symbologies contained within said framed symbology image field including means for correcting for skewed orientation of said one or more symbologies within a symbology image field.

20. The combination of claim 16, further comprising a band pass filter coupled with the optical assembly.

21. The combination of claim 16, further comprising a phase filter coupled with the optical assembly.

22. The combination of claim 21, wherein the phase filter is a Fresnel phase zone plate (FPZP).

23. The combination of claim 21, wherein the phase filter is an aspheric phase optical element (APOE).

24. The combination of claim 16, wherein the detector is a Charge Coupled Device (CCD) having an electronic shutter with electronically adjustable speeds and having a maximum peak sensitivity of 590 nanometers.

25. The combination of claim 24, wherein the illumination light source is at least one light emitting diode (LED) having a peak output wavelength corresponding to the maximum peak sensitivity of the CCD.

26. The combination of claim 25, wherein the illumination light source is a pair of LEDs, each LED of the pair of LEDs disposed on either side of said optical path and each LED casting a LED light beam having a wide angular output of 23 degrees.

27. The combination of claim 26, further comprising a pair of collecting-projection lens, each said collecting-projection lens spaced a predetermined distance from each pair of LEDs to capture each LED light beam of each LED in each pair over said wide angular output.

28. The combination of claim 27, wherein each said collecting-projection lens has a first side and a second side, wherein said first side is disposed closer of said pair of LEDs and said second side serves as an output point for passing each said LED light beam, and said first side serves as a diffuser having a surface relief hologram disposed thereon for uniformally distributing the intensity of each said LED light beam of each said pair of LEDs at said output point of second side.

29. The combination of claim 28, wherein said diffuser distributes said LED light beam such that it is elliptically shaped, wherein the major axis of said ellipitical shaped beam is dispersed parallel to said optical path and the minor axis of said elliptical shaped beam is dispersed normal to said major axis, and the elliptical aspect ratio of the major axis compared to the minor axis is about 2:1.

30. The combination of claim 20, wherein the bandpass filter is centered on the wavelength of each LED light beam such that decoding of a symbology in a symbology image field is possible in absence of ambient light other than said LED light beam or in direct sunlight.

31. In an optical scanning device for reading a one- or two-dimensional symbology having a first width, said optical scanning device comprising at least one printed circuit board having a front edge with a second width, a light source mounted on said at least one printed circuit board, said light source for projecting an incident beam of light onto said symbology, said incident beam of light having substantially said second width at said front edge of said at least one printed circuit board and a first height and a third width at said symbology, said third width being greater than said second width and at least as large as said

first width, an optical assembly comprising a plurality of lenses disposed on said at least one printed circuit board along an optical path for receiving and focusing light reflected from said framed symbology to obtain a focused light at a focal plane, [said optical assembly having moving means for moving at least one of said plurality of lenses with respect to other lenses of said plurality to provide a variable field of view,] a detector disposed on said at least one printed circuit board within said optical path substantially at said focal plane of said optical assembly for detecting at least a portion of said focused light within [said variable] a field of view of said detector, said [variable] field of view having said first height and said third width, said detector for sensing said focused light to obtain a sensed symbology, a processor for processing said sensed symbology to obtain an electrical signal; and an output means for converting said electrical signal into output data; the improvement comprising:

at least one framing means disposed on said at least one printed circuit board for framing said symbology to identify an area to be scanned by said scanner, wherein said at least one framing means comprises:

at least one light source for emitting a beam of light;

at least one diffractive optic for transforming said beam of light into a plurality of diverging beamlets; and

at least one refractive optical element disposed in an optical path of each of said plurality of diverging beamlets for directing said plurality of diverging beamlets to project spots of light to frame said [variable] field of view, whereby said [variable] field of view is identified.

32. The optical scanning device of claim 31, wherein said at least one refractive optical element is at least one wedge-shaped prism.

33. The optical scanning device of claim 32, wherein said at least one refractive optical element includes a pair of wedge-shaped prisms, a first prism providing a horizontal divergence and a second prism providing a vertical divergence.

34. The optical scanning device of claim [32] <u>44</u>, wherein said at least one refractive optical element comprises a first refractive optical element for framing a narrow field

of view of said variable field of view, and a second refractive optical element for framing a wide field of view of said variable field of view.

35. The optical scanning device of claim 34, wherein said first and second refractive optical elements are disposed on a rotatable ring and further comprising a linkage for rotating said rotatable ring in response to movement of moving means to project each beamlet of said diverging beamlets through a corresponding first refractive optical element when said moving means causes said narrow field of view to be selected and to project said each beamlet through a corresponding second refractive optical element when said moving means causes said wide field of view to be selected.

36. The optical scanning device of claim 35, wherein said linkage comprises camming means.

37. The optical scanning device of claim 31, wherein said light source is a laser diode.

38. The combination of claim 5, wherein said optical assembly includes moving means for moving at least one of said plurality of lenses with respect to other lenses of said plurality of lenses to provide a variable field of view, said variable field of view having said first height and said third width, and wherein said light source of said optical framing locator means directs light for framing said symbology image within a selected field of view of said variable field of view.

39. The combination of claim 1, wherein said optical framing locator means frames said symbology image by directing light in intersecting horizontal and vertical lines that define dimensions of said symbology image.

40. The combination of claim 1, wherein the illumination light source is at least one light emitting diode (LED).

41. The combination of claim 16, wherein said optical assembly includes moving means for moving at least one of said plurality of lenses with respect to other lenses of said plurality of lenses to provide a variable field of view, said variable field of view having said first height and said third width, and said one or more refractive optical elements are movable for selectively focusing said plurality of diverging beamlets in response to said movement of said at least one of said pluralilty of lenses, for

selectively forming said laser beamlets within a selected field of view of said variable fields of view.

42. The combination of claim 16, wherein said optical framing locator means frames said symbology image to identify an area to be scanned by said scanner by directing light in horizontal and vertical lines that define dimensions of said symbology image.

43. The combination of claim 16, wherein the illumination light source is at least one light emitting diode (LED).

44. The optical scanning device of claim 31, wherein said optical assembly includes moving means for moving at least one of said plurality of lenses with respect to other lenses of said plurality of lenses to provide a variable field of view, said variable field of view having said first height and said third width, and said at least one refractive optical element disposed in an optical path of each of said plurality of diverging beamlets directs said plurality of diverging beamlets to project spots of light to frame said variable field of view, whereby said variable field of view is identified.

45. The optical scanning device of claim 31, wherein said framing means frames said symbology image to identify an area to be scanned by said scanner by directing light in horizontal and vertical lines that define dimensions of said symbology image.

46. The optical scanning device of claim 31, wherein the illumination light source is at least one light emitting diode (LED).